

**USDA
 NATURAL RESOURCES
 CONSERVATION SERVICE
 DELAWARE
 CONSERVATION
 PRACTICE STANDARD

 WETLAND RESTORATION

 CODE 657
 (Reported by Acre)**

DEFINITION

The rehabilitation of a drained or degraded wetland where the soils, hydrology, vegetative community, and biological habitat are returned to the natural conditions to the extent practicable.

PURPOSE

This practice may be applied for one or more of the following purposes:

- Create or enhance wildlife habitat;
- Provide offsite water quality benefits;
- Provide other natural wetland functions.

CONDITIONS WHERE PRACTICE APPLIES

Restoration applies to rehabilitating natural wetlands which were hydrologically and/or vegetatively manipulated in the past. These sites may have been completely converted to non-wetland conditions by filling, draining, or other hydrologic changes, or they may still meet wetland criteria but have impaired functions due to hydrologic or vegetative modifications.

This practice is applicable only if the site will be restored, as nearly as possible, to the original hydrologic conditions and plant communities which are likely to have existed before the wetland was modified.

This practice does not apply to:

- Sites where a wetland will be restored and maintained with a hydrologic regime and/or plant community different from those which previously existed before the wetland was modified. (Refer to the conservation practice standard for Wetland Creation, Code 658.)
- Sites where a wetland will be created in a location which historically was not a wetland. (Refer to the conservation practice standard for Wetland Creation, Code 658.)
- Sites where a wetland will be constructed to treat significant point and non-point sources of water pollution. (Refer to the conservation practice standard for Constructed Wetland, Code 656.)

CONSIDERATIONS

- Consider the long-term land use objectives of the client. If the land user is interested in providing wildlife habitat, consider the wildlife species or groups of species to be supported and the habitat needs which can be met on the managed area.
- Consider the natural availability of plant species in the soil seed bank vs. the need for planting in the restored wetland and upland buffer.
- Consider the adverse impacts of nearby populations of nuisance wildlife such as muskrats, beavers, or resident geese, on the establishment and maintenance of the site. Also consider the potential for attracting nuisance wildlife into an area.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service

- For muskrat control, build a 6 foot flat bench along the embankment, with normal water depth of 3-4 inches. This will discourage muskrats from burrowing into the embankment.
- Take note of other constraints such as economic feasibility, access, regulatory or program requirements, social effects, and visual aspects.
- Consider long-term maintenance requirements of the restored wetland.

Refer to Chapter 13 of the Engineering Field Handbook for further discussion of these planning considerations. Refer to the Maryland Wildlife Biology and Management Handbook for additional habitat considerations for wildlife species.

This practice has the potential to affect National Register listed cultural resources or eligible (significant) cultural resources. These may include archeological, historic, or traditional cultural properties. Care should be taken to avoid adverse impacts to these resources. Follow NRCS state policy for considering cultural resources during planning.

CRITERIA

Hydrology

Hydrologic conditions, including natural microtopography of the soil surface, shall be restored as nearly as feasible to the conditions which originally existed on the site. The minimum hydrologic conditions of the site shall meet current NRCS criteria for wetland hydrology.

The size and character of the watershed above the site shall be assessed under present and future conditions in order to determine available hydrology.

Hydrology may be restored by using a variety of measures, including but not limited to embankments, surface drain plugs, subsurface drain plugs, removal of fill material, and shallow excavation. These measures may not be needed on restoration sites where the natural hydrology has not been significantly modified.

A soils investigation shall be performed to determine conditions for minimizing seepage losses; suitability of materials for embankment construction; adequacy of subsurface water supply; and capability to support desired plant materials, as applicable.

After the site is restored, the soil shall generally remain undisturbed so that the wetland will perform its natural functions, including (but not limited to) accumulation of organic matter, nutrient and contaminant sequestration, and retention of surface and subsurface water.

Embankments – Small embankments may be used to impound water and provide wetland hydrology. Embankments, which meet the definition and criteria for an embankment pond (as described in the conservation practice standard for Pond, Code 378), are not considered small embankments and shall be designed according to the embankment criteria for Pond. Fill that will be entirely within a surface drainage ditch shall be designed according to the criteria for Surface Drain Plugs, as described in the conservation practice standard for Wetland Restoration, Code 657.

Small embankments shall have a minimum top width of 4 feet, and combined upstream and downstream side slopes of 6:1, with neither slope steeper than 2:1.

When needed to maintain the desired depth and duration of surface water on the site, appropriate measures shall be taken to minimize seepage losses through the embankment and subsoil.

Surface Drain Plugs - In areas where open ditches were constructed to provide drainage, wetland hydrology may be restored by constructing surface drain plugs, using a pipe riser or other structures within the ditch to control the water level, or by filling a surface drain to the original ground line. Refer to the criteria for Embankments when fill will be placed on the ditch banks.

Provisions shall be made to store, pass through, or divert excess runoff. Structure capacity shall be determined using the Engineering Field Handbook, Chapter 14.

The minimum length of the surface drain plug shall

be 50 feet. All fill shall be relatively impermeable and be compacted to achieve the density of adjacent materials. The fill for the surface drain plug shall be crowned a minimum of one foot above the top of the lower existing channel bank to account for settling.

Subsurface Drain Plugs - In areas where subsurface drains were used to lower the water table, wetland hydrology may be restored by removing or plugging the drain or replacing the perforated drain with a non-perforated drain.

The minimum length of drain to be removed or plugged shall be as follows:

Length of Drain	Avg. Hydraulic Conductivity of Soil
50 feet	<0.6 inches/hour
100 feet	0.6 to 2.0 inches/hour
150 feet	>2.0 inches/hour

All envelope filter material or other flow enhancing material shall also be removed for this length. The trench used to alter the drain shall be filled and compacted to achieve a density equal to adjacent natural soil material.

When subsurface drains also function as outlets for other drained areas where drainage is still desired, appropriate measures must be incorporated to keep the upstream drainage systems functional. A non-perforated pipe shall replace the perforated pipe through the wetland area to be restored, and shall extend beyond the wetland in all directions at least the minimum length previously specified for the length of drain to be removed or plugged. Drains may also be re-routed around the wetland at the same minimum distances from the wetland, or where topography permits, setting a water control structure at a level that does not affect upstream drainage.

A water control structure may be placed on the inlet of an existing drain. The water control structure shall be attached to a non-perforated conduit that extends at least the minimum length previously specified for length of drain to be

removed. The connections of the water control structure and the non-perforated pipe shall be watertight.

Spillways – Spillways shall be provided for safe passage of water. Pipe conduits and vegetated spillways shall be designed accord-in to the Engineering Field Handbook. Trash racks shall be required on inlets to pipe conduit spillways.

Spillway(s) shall be designed to pass the 10-year, 24-hour storm. A minimum of 0.5 foot of free-board shall be provided above the 10-year flow depth. There shall be a minimum of 1 foot between the normal pool elevation and the top of the embankment.

When there is no surface inflow entering the shallow water area from off-site (i.e., no drainage area), spillway(s) shall be designed to release the volume of the 10-year, 24 hour storm within an appropriate amount of time for management of the desired plant community. The amount of time needed for release of excess water on a specific site shall be determined based on the depth of inundation and the species of plants desired on the site. A minimum of 0.5 foot of freeboard shall be provided above the 10-year rainfall depth.

Shallow water areas in which hydrology will be manipulated by a managed drawdown shall be designed with a suitable outlet for dewatering the site, or shall include provisions for pumping to remove water within the desired time limits. When moist-soil management is planned, outlet structures shall be designed to accommodate slow release rates.

Anti-seep collars shall be required around conduits 6 inches or larger in diameter being placed in earth fills over 2 feet high. The anti-seep collars shall have a minimum 1-foot projection around the pipe.

Removal of Fill Material - Where a wetland has been filled by sediment, land shaping, or other activities, the hydrology may be restored by removing the fill material from the site. Fill material shall be removed to the top of the buried hydric soil, placed on an upland site, and stabilized so that no erosion of the material occurs.

If hazardous wastes are suspected in the fill

material, samples shall be collected and analyzed for the presence of hazardous waste in accordance with local, state, and federal requirements. Sites containing hazardous wastes shall not be restored under this standard unless the appropriate hazardous waste authority determines that the site can be decontaminated.

Shallow Excavation – A wetland may be restored by excavating below the existing ground surface to create a shallow basin or microtopography, which will hold surface water and/or intercept groundwater. The basin shall permit storage of water at a depth, frequency, and duration as closely as possible to the original hydrologic conditions on the site.

Hydrophytic Vegetation

Hydrophytic vegetation shall be established in the restored wetland, either naturally or by planting, or by a combination of these methods. On sites where seeds, rootstocks, and other propagules of desired species are already present in the soil or are likely to be transported to the site from nearby sources, natural regeneration shall be the preferred method of establishing the natural plant community. Planting shall be used as appropriate to hasten establishment of desired species or supplement the natural regeneration process.

Selection of locally native species shall be a priority when feasible. Planting recommendations shall not include non-native invasive species.

At least 70 percent of the wetland area shall be restored to the natural plant community which is typically found in a wetland in the same physiographic region and similar landscape position. Where woody vegetation was originally present, a suitable precursor to the original community may be established which will, over time, allow a mature wetland plant community to develop.

Up to 30 percent of the wetland area may be restored and maintained as shallow, open water and/or as a wetland plant community different from that which originally occurred on the site. The purpose of this modification shall be to support a diverse plant and animal community.

Wetland vegetation shall meet the following

criteria for areal coverage and density, regardless of whether natural regeneration or planting is used: (1) Herbaceous vegetation shall be designed to achieve a minimum 85 percent areal cover of the desired herbaceous species after five years; (2) Woody vegetation shall be designed to achieve a minimum density of 200 trees per acre, 300 trees and shrubs per acre, or 400 shrubs per acre after five years.

Specific program requirements, especially concerning mitigation or restoration, may establish criteria different than those listed above.

Wetland Buffer - A buffer zone at least 35 feet wide shall be established around the site to protect the wetland. The buffer may consist of an existing, well-vegetated plant community comprised of perennial grasses, forbs, and/or woody species, or a plant community may need to be established either by natural regeneration or by planting. Selection of plant species to be established in the buffer shall be based on the planned functions of the buffer. Refer to the conservation practice standard Conservation Cover, 327, for plant species.

For purposes of this standard, the buffer requirement does not apply to the portion of the site occupied by structural measures such as embankments or surface drain plugs.

SPECIFICATIONS

Plans and specifications for the restoration of a wetland site shall be prepared in accordance with the previously listed design criteria. Plans and specifications shall contain sufficient detail concerning hydrology, soils, and vegetation to ensure successful installation of the practice. Documentation shall be in accordance with the section "Supporting Data and Documentation" in this standard. The following engineering and vegetative specifications shall be followed, with additional items added where appropriate:

Engineering Specifications

Erosion and Sediment Control - Construction operations shall be carried out in such a manner that erosion will be controlled and water and air pollution minimized both on-site and off-site. State and local laws concerning pollution abatement shall be followed. Construction plans shall detail erosion and sediment control measures to be employed during the construction process.

Site Preparation - Areas designated for borrow areas, embankment, and structural works shall be cleared, grubbed, and stripped of topsoil. All trees, vegetation, roots, and other debris shall be removed from embankment fill.

All cleared and grubbed material shall be disposed of outside the limits of the wetland and wetland buffer in uplands or prior converted cropland, except as specified in the restoration plan. When specified, a sufficient quantity of topsoil shall be stockpiled in a suitable location for use on designated areas. Selected woody debris shall also be stockpiled for use within the developed or restored wetland, when specified.

Embankment Earth Fill - The following specifications shall be used:

1. **Material** - The fill material shall be taken from approved designated borrow areas. It shall be free of organic matter, roots, stumps, wood, rubbish, stones greater than 6 inches, frozen or other objectionable materials.
2. **Placement** - Areas on which fill is to be placed shall be scarified prior to placement of fill. Fill materials shall be placed in layers

which are a maximum 8 inches thick before compaction. These layers shall be continuous over the entire length of the fill. The most permeable borrow material shall be placed in the downstream portions of the embankment. The principal spillway must be installed concurrently with fill placement and not excavated into the embankment.

3. **Compaction** - The movement of the hauling and spreading equipment over the fill shall be controlled so that the entire surface of each lift shall be traversed by not less than one tread track of the equipment or compaction shall be achieved by a minimum of four complete passes of a sheepsfoot, rubber tired, or vibratory roller. Fill material shall contain sufficient moisture such that the required degree of compaction will be obtained with the equipment used. The fill material shall contain sufficient moisture so that if formed into a ball it will not crumble, yet not be so wet that water can be squeezed out.
4. **Structural backfill** - Backfill adjacent to pipes or structures shall be of the type and quality conforming to that specified for the adjoining fill material. The fill shall be placed in horizontal layers not to exceed four inches in thickness and compacted by hand tampers or other manually directed compaction equipment. The material needs to completely fill all spaces under and adjacent to the pipe. At no time during the backfilling operation shall driven equipment be allowed to operate closer than four feet, measured horizontally, to any part of a structure. Under no circumstances shall equipment be driven over any part of a concrete structure or pipe, unless there is a compacted fill of 24 inches or greater over the structure or pipe.

Pipe Conduits - Specifications for pipe conduits shall conform to the requirements in the Conservation Practice Standard for Pond, Code 378.

Concrete - Concrete shall meet the requirements of USDA, NRCS, Delaware Material Specification 201, Concrete.

Rock Riprap - Rock riprap shall meet the requirements of USDA, NRCS, Delaware Ma-

terial Specification 213, Rock for Riprap.

The riprap shall be placed to the required thickness in one operation. The rock shall be delivered and placed in a manner that will insure the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks filling the voids between the larger rocks.

Filter cloth shall be placed under all riprap and shall meet the requirements of USDA, NRCS, Delaware Material Specification 222, Geotextile Fabric Woven and Nonwoven.

Care of Water during Construction - All work on permanent structures shall be carried out in areas free from water. The contractor shall construct and maintain all temporary dikes, levees, cofferdams, drainage channels, and stream diversions necessary to protect the areas to be occupied by the permanent works. The contractor shall also furnish, install, operate, and maintain all necessary pumping and other equipment required for removing water from the various parts of the work and for maintaining the excavations, foundation, and other parts of the work free from water as required.

After having served their purpose, all temporary protective works shall be removed or leveled and graded to the extent required to prevent obstruction of the flow of water to the spillway or outlet works and so as not to interfere with the operation or maintenance of the structure. Stream diversions shall be maintained until the full flow can be passed through the permanent works. The removal of water from the required excavation and the foundation shall be accomplished to maintain stability of the excavated slopes and bottom of required excavations and allow satisfactory performance of all construction operations. During the placing and compacting of material in required excavations, the water level at the locations being refilled shall be maintained below the bottom of the excavation at such locations which may require draining the water to sumps from which the water shall be pumped.

Final Grading - All upland borrow areas shall be graded to provide proper drainage and left in a stable condition.

On sites which have been in long-term agricultural

use, grading and shaping shall be used to restore the diverse microtopography which occurs naturally in wetlands.

Vegetative Specifications

Topsoiling - Topsoil that was removed from borrow areas shall be spread to a depth of 4 to 6 inches where needed to provide a suitable medium for plant growth—in both the buffer area and wetland area. Do not redistribute topsoil that is known to contain invasive or noxious weeds.

Organic Matter Amendments for the Wetland Area - If an insufficient quantity of topsoil is available or if it is low in organic carbon, then organic matter such as straw, composted manure, or wood chips shall be used on the portion of the site that is designed to be inundated. Organic matter (organic carbon) is necessary to restore the natural functions of a wetland, including sustaining beneficial microbes and aquatic invertebrates.

A soil surface horizon (the 'A' horizon) with a value and chroma <3 normally contains at least 1% organic matter, and does not need to be augmented. However, if the 'A' horizon has a value and chroma >3, then add the following organic matter to the wetland area:

1. Straw - Spread straw over the soil surface to a minimum thickness of 3 inches (1.5 to 2 tons/acre).
2. Manure - Spread a minimum of 10 tons/acre of cow or horse manure.
3. Wood Chips - Spread hardwood chips (not bark) at a rate of 500 cubic yards per acre.

Site Stabilization - The wetland buffer shall be stabilized, either by planting or natural regeneration, according to the conservation practice standards Riparian Forest Buffer, Code 391, or Riparian Herbaceous Cover, Code 390, as appropriate. All other non-wetland exposed surfaces (such as embankments) shall be stabilized by liming, fertilizing, seeding, and mulching in accordance with the conservation practice standard for Critical Area Planting, Code 342, or as shown on the project plans.

Areas within the restored wetland which need temporary herbaceous cover to control erosion and to help build the organic components of the soil shall be stabilized with an appropriate grass seed mix for wetlands. Temporary seeding may be needed in areas where: (1) natural regeneration is planned, (2) woody species will be planted, or (3) permanent plantings will be delayed. The temporary planting shall be non-competitive to the introduction and establishment of the desired species.

Natural Regeneration - Where natural regeneration will be used as the primary method to restore the wetland plant community, specifications shall include the following requirements concerning the treatment of seed banks and seeds from off-site sources in order to provide appropriate conditions for plant germination and establishment:

1. **Soil seed banks** - Where an on-site soil seed bank is used to establish a mature plant community, soil disturbance shall be minimized within the wetland site. Measures shall be taken to avoid compaction and mixing of the soil seed bank during construction, so that the plant propagules are disturbed as little as possible.

For early successional species, which are generally tolerant of disturbance, mixing of the soil seed bank may be allowed, but compaction of the soil seed bank shall be avoided.

2. **Seeds from nearby sources** - Where vegetation will be established by reliance on seeds transported from nearby sources, seedbed preparation shall consist of reducing competition from existing vegetation (if any), ensuring good seed to soil contact, and providing a soil surface layer suitable for root penetration. Areas that are heavily compacted shall be disked or otherwise worked to a depth of 6 inches. Topsoil or other organic matter shall be included where needed, as previously described.

Establishment of Vegetation by Planting - The following specifications shall be used:

1. **Types of plant materials** - Vegetation may be established by using seed, bulbs, tubers, rhizomes, cuttings, bare-root seedlings, and containerized stock. Younger planting stock is generally preferred to older stock because younger plants adapt more readily to new conditions.

Seedlings and containerized stock shall be wetland grown.

Except for grasses, direct seeding is generally not recommended as a reliable method for plant establishment, due to the lack of information concerning seed viability, germination, and seedling growth requirements under field conditions.

2. **Proper treatment of plant materials** - All plant materials shall be correctly handled before planting. In general, plants shall be planted as soon as possible after receiving them from the supplier. Seed, bulbs, tubers, and rhizomes shall be kept cool and dry until planted. For cuttings and bare-rooted seedlings, the cut ends or roots shall be kept moist at all times and the plants shall be kept out of direct sunlight as much as possible.
3. **Planting periods** - In general, plants should be planted early in the growing season so root systems can become well established before winter.
4. **Seedbed preparation** - Areas that have been heavily compacted shall be disked or otherwise worked to a depth of 6 inches before planting. Topsoil or other organic matter shall be included where needed, as previously described.
5. **Installing the plants** - Seed shall be planted on a prepared seedbed by broadcasting the seed uniformly over the area. If the soil is dry, the planted area shall be cultipacked, rolled, or raked lightly to cover the seed to a depth of 1/4 to 1/2-inch. On a moist seedbed, a light layer of soil or mulch shall be used to cover the seed.

Other plant materials (except seed) shall be installed in moist soil or in shallow surface water. If the site is dry, the plants shall be watered immediately after planting.

Rhizomes, tubers, corms, bulbs, and un-

rooted cuttings shall be installed by placing each plant into the soil to a depth of 3 to 4 inches, then firming the soil around it. If necessary, a planting bar or similar tool shall be used to open a slot in the ground.

Containerized stock shall be planted by making a hole in the soil wide enough and deep enough to hold the root ball. The container shall be removed, or if a peat pot, the pot shall be torn in several places. The roots of potbound stock shall be slightly cut to facilitate proper rooting. Each plant shall be placed in the ground so that the soil level on the root ball is at or just above ground level. Soil shall be firmed around the root ball to eliminate large voids in the soil and ensure good root to soil contact.

Bare-rooted stock shall be planted in a similar fashion, with the holes made deep enough to accommodate the roots. Each plant shall be placed at a depth such that the topmost roots will be covered by approximately 1 inch of soil. Roots shall be spread out as much as possible when the plant is set into the hole. Soil shall be firmed around each plant after planting.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for each wetland restoration site. At a minimum, the following components shall be addressed in the plan:

Structures

Describe what inspections are required to assess the integrity of the structure and determine whether it is functioning properly. Also describe the extent of vegetative management which will be needed on embankments and/or surface drain plugs.

Removal of Sediment and Other Repairs

Describe locations where sediment removal is acceptable (e.g., designed sediment basins, open water areas); conditions under which sediment may be removed and repairs made (e.g., time of year restrictions, permits needed, etc.).

Vegetation in the Wetland and Buffer Area

Describe what inspections are required to determine whether the desired vegetation is present in suitable quantity, quality, and distribution to meet objectives of the project. Describe the extent of management needed to maintain vegetation in the desired species composition or age class (if applicable), or no management required (e.g., natural area).

Nuisance Plants and Animals

Describe the extent to which plant and animal pest species, including noxious weeds, will need to be controlled.

Acceptable Uses

Describe the acceptable uses (e.g., timber production, grazing, hunting, nature preserve, etc.) and time of year/frequency of use restrictions, if any.

Frequency of Inspections

At a minimum, require annual inspections of structural and vegetative components.

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

Planning Information, Field Data, and Survey Notes

1. Field location of the project, acres, and assistance. Also note the location of the project on the conservation plan map.
2. Description of the objectives of the project, including the desired functions which the wetland is expected to provide.
3. Soil investigation logs and notes.
4. Inventory of existing vegetation on the site. If applicable and available, note the agrichemicals which have been used on the site during the past 5 years.
5. Topographic survey of the site, as appropriate for site conditions and the proposed design.
6. Description of existing drains and extent of existing blockage (if any).

Design Data

1. Hydrologic and hydraulic design computations.
2. Typical cross-section and profile of embankment, if required.
3. Profile of vegetated spillway, if required.
4. Elevation of conduit/riser pipe and/or tile inlet riser, if required.
5. Planned blockage of drainage systems, including cross sections and lengths of drain plugs, if required.
6. Plan view(s) showing topographic contours, planting zones for vegetation, and locations of other features, as appropriate.

7. Seeding and/or planting requirements, including species selected for each planting zone, stocking/seeding rates, and type of planting stock to be used (e.g., bare-rooted seedlings, containerized stock, etc.).
8. Operation and maintenance plan.

Construction Check Data/As Built

1. Check notes recorded during or after completion of construction showing as-built conditions of all structures.
2. Note plant species as-installed, including species, quantities, date(s) planted, and arrangement of plants within each planting zone.
3. Sign and date construction check notes to include statement that practice meets or exceeds plans and specifications.

REFERENCES

1. Delaware Department of Transportation, State Highway Administration, Standard Specifications for Construction and Materials.
2. Environmental Concerns, Inc. Wetland Planting Guide for the Northeastern United States. St. Michaels, MD, 1993.
3. Natural Resources Conservation Service, Conservation Practice Standard for Conservation Cover (Code 327).
4. Natural Resources Conservation Service, Conservation Practice Standard for Constructed Wetland (Code 656).
5. Natural Resources Conservation Service, Conservation Practice Standard for Critical Area Planting (Code 342).
6. Natural Resources Conservation Service, Conservation Practice Standard for Pond (Code 378).
7. Natural Resources Conservation Service, Conservation Practice Standard for Riparian Forest Buffer (Code 391).
8. Natural Resources Conservation Service, Conservation Practice Standard for Riparian Herbaceous Cover (Code 390).
9. Natural Resources Conservation Service, Conservation Practice Standard for Wetland Creation (Code 658).
10. Natural Resources Conservation Service, Engineering Field Handbook, Chapter 6 "Structures," Chapter 11 "Ponds and Reservoirs," Chapter 13 "Wetland Restoration, Enhancement or Creation," and Chapter 14 "Drainage."
11. Natural Resources Conservation Service, Maryland Wildlife Biology and Management Handbook.
12. Natural Resources Conservation Service & Duck Unlimited Canada, Vegetating with Native Grasses in Northeastern North America.
13. Slick and Curtis, A Guide for the use of Organic Materials as Mulches in Reclamation of Coal Minesoils in the Eastern United States, General Technical Report NE-98. USDA, Forest Service, Northeast Experiment Station, 1985.

FIGURE 1: USDA Plant Hardiness Zones for Delaware

Plant Hardiness Zones delineate areas where a species can be successfully established based on average annual minimum temperatures.

TABLE 1: Recommended Planting Dates for Delaware		
Type of Plant Material	Plant Hardiness Zones	
	6b	7a and 7b
Seeds - Cool-Season Grasses	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 1 to Apr 30 Aug 15 to Nov 30
Seeds - Warm-Season Grasses	Apr 1 to Jun 15 Jun 15 to Jun 30*	Mar 15 to May 31 Jun 1 to Jun 30*
Dormant Planting ^{1/} – Cuttings, Bare-Root Seedlings, Bulbs, Rhizomes, Corms, and Tubers	Feb 15 to Mar 14 Nov 15 to Nov 30	Feb 1 to Feb 28 Nov 15 to Nov 30
Bare-Root Seedlings, Bulbs, Rhizomes, Corms, and Tubers	Mar 15 to May 15 May 16 to Jun 30*	Mar 1 to Apr 30 May 1 to Jun 30*
Containerized Stock ^{2/}	Mar 15 to May 15 May 16 to Jun 30* Sep 15 to Oct 15*	Mar 1 to Apr 30 May 1 to Jun 30* Oct 1 to Nov 15*

Notes: Except for grasses, revegetation by direct seeding is usually not a preferred method for wetland plant establishment, due to the lack of information related to seed viability, germination, and seedling growth requirements for the majority of wetland plant species.

* Additional planting dates during which supplemental watering may be needed to ensure plant establishment.

^{1/}, ^{2/} Frequent freezing and thawing of wet soils may result in frost-heaving of materials planted in late fall, if plants have not sufficiently rooted in place.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/ Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
Water Regime: Surface Saturation to Infrequent Inundation								
ASTER, NEW ENGLAND <i>Aster novae-angliae</i>	All	Statewide; common	FACW-	3-6 ft.	Slow	○ - ◐	Flowers attractive to butterflies. Seeds eaten by songbirds.	Wet meadows. Prefers full sun. Attractive clusters of purple flowers.
ASTER, NEW YORK <i>Aster novi-belgii</i>	All	Mostly Coastal Plain; common	FACW+	3-6 ft.	Slow	○ - ◐	Flowers attractive to butterflies. Seeds eaten by songbirds.	Wet meadows. Prefers full sun. Attractive clusters of violet flowers.
ASTER, PURPLE-STEMMED <i>Aster puniceus</i>	All	Statewide; common	OBL	3-6 ft.	Slow	○ - ◐	Flowers attractive to butterflies. Seeds eaten by songbirds.	Wet meadows. Prefers full sun. Attractive clusters of violet flowers.
BENTGRASS <i>Agrostis stolonifera</i>	All	Statewide	FACW	<3 ft.	Slow	○	Seeds eaten by songbirds.	Wet meadows. Cool-season grass with creeping habit.
BLUEGRASS, FOWL <i>Poa palustris</i>	6b	Piedmont	FACW	<3 ft.	Slow	○ - ◐	Seeds eaten by songbirds.	Wet meadows. Cool-season grass.
BLUESTEM, BUSHY <i>Andropogon glomeratus</i>	All	Coastal Plain	FACW+	<3 ft.	Fast	○	Seeds eaten by songbirds.	Wet meadows. Warm-season grass with stiff stems.
BONESET <i>Eupatorium perfoliatum</i>	All	Statewide; common	FACW+	3-6 ft.	Slow	○ - ◐	Flowers attractive to butterflies.	Wet meadows. Small white flower clusters.
CARDINAL FLOWER <i>Lobelia cardinalis</i>	All	Statewide; common	FACW+	<3 ft.	Slow	◐	Flowers attractive to hummingbirds & butterflies.	Wet meadows and open forested wetlands. Spike of attractive bright red flowers.
CORDGRASS, SALTMEADOW <i>Spartina patens</i>	All	Coastal Plain; common	FACW+	<3 ft.	Fast	○	Seeds eaten by waterfowl & songbirds. Roots eaten by waterfowl and muskrats.	Tidal marshes above MHT. Warm-season grass. Salinity 0 – 35 ppt.

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FERN, MARSH <i>Thelypteris thelypteroides</i>	All	Statewide; common	FACW+	<3 ft.	Fast	○ - ◐	Minimal value for food. Occasionally browsed by deer.	Open forested wetlands and wet meadows.
IRONWEED <i>Vernonia noveboracensis</i>	All	Statewide; common	FACW+	3-6 ft.	Slow	○	Flowers attractive to butterflies.	Wet meadows. Deep purple flower clusters.
JOE-PYE WEED <i>Eupatoriadelphus fistulosus</i>	All	Statewide	FACW	3-6 ft.	Slow	○ - ◐	Flowers attractive to butterflies.	Wet meadows. Pink-purple flower clusters.
JOE-PYE WEED, SPOTTED <i>Eupatoriadelphus maculatum</i>	6b	Piedmont	FACW	3-6 ft.	Slow	○ - ◐	Flowers attractive to butterflies.	Wet meadows. Pink-purple flower clusters.
LOBELIA, BLUE <i>Lobelia siphilitica</i>	All	Statewide; common in Piedmont.	FACW+	<3 ft.	Slow	◑	Flowers attractive to butterflies. Leaves and stems eaten by deer.	Wet meadows (often in shade) and saturated forested wetlands. Attractive blue flower spike.
MILKWEED, SWAMP <i>Asclepias incarnata</i>	All	Statewide; common	OBL	3-6 ft.	Slow	○	Flowers attractive to butterflies.	Wet meadows. Small pink flowers in clusters.
MONKEY FLOWER, WINGED <i>Mimulus alatus</i>	All	Statewide; less common on Coastal Plain	OBL	<3 ft.	Slow	○	Flowers attractive to butterflies.	Wet meadows. Pink-purple flowers similar to snapdragons.
MONKEY FLOWER, ALLEGHANY <i>Mimulus ringens</i>	All	Statewide; common	OBL	<3 ft.	Slow	○ - ◐	Flowers attractive to butterflies.	Openings in saturated forested wetlands. Pink-purple flowers similar to snapdragons.
NUTSEDGE, YELLOW <i>Cyperus esculentus</i>	All	Statewide; common	FACW	<3 ft.	Fast	○	Seeds eaten by song-birds, waterfowl. Tubers eaten by waterfowl.	Wet meadows. Often planted for waterfowl food.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
REEDGRASS, WOOD <i>Cinna arundinacea</i>	All	Statewide; common	FACW+	3-6 ft.	Slow	○ - ◐	Seeds eaten by song-birds. Foliage eaten by deer.	Saturated forested wetlands. Cool-season grass.
VERVAIN, BLUE <i>Verbena hastata</i>	All	Statewide; common	FACW+	3-6 ft.	Slow	○	Seeds eaten by song-birds.	Wet meadows. Small blue flowers in spikes.
WILD RYE, VIRGINIA <i>Elymus virginicus</i>	All	Statewide	FACW-	<3 ft.	Fast	○ - ◐	Foliage eaten by wildlife in early spring.	Wet meadows and river banks. Cool-season grass.
Water Regime: Surface Saturation to +3 inches of Surface Water								
CUTGRASS, RICE <i>Leersia oryzoides</i>	All	Statewide; common	OBL	<3 ft.	Fast	○	Seeds eaten by waterfowl, songbirds. Roots eaten by waterfowl.	Shallow fresh marshes & wet meadows. Cool-season grass. Leaves have sawtoothed edges.
FERN, SENSITIVE <i>Onoclea sensibilis</i>	All	Statewide; common	FACW	<3 ft.	Fast	○ - ●	Minimal value for food. Occasionally browsed by deer.	Wet meadows and saturated forested wetlands.
FERN, CINNAMON <i>Osmunda cinnamomea</i>	All	Statewide; common	FACW	3-6 ft.	Slow	●	Minimal value for food. Occasionally browsed by deer.	Saturated forested wetlands.
FERN, ROYAL <i>Osmunda regalis</i>	All	Statewide; common	OBL	3-6 ft.	Slow	◐ - ●	Minimal value for food. Occasionally browsed by deer.	Wooded swamps and saturated forested wetlands.
IRIS, BLUE <i>Iris versicolor</i>	All	Statewide; common	OBL	<3 ft.	Slow	○	Plants eaten by muskrats.	Shallow fresh marshes. Attractive blue flower.
IRIS, VIRGINIA <i>Iris virginica</i>	All	Mostly Coastal Plain; uncommon	OBL	<3 ft.	Slow	○	Plants eaten by muskrats.	Shallow fresh marshes. Attractive blue flower.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/ Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
MALLOW, MARSH <i>Kosteletzkya virginica</i>	7a, 7b	Coastal Plain	OBL	3-6 ft.	Slow	○	Flowers attractive to hummingbirds.	Brackish & fresh tidal marshes; saturated soils above MHT. Salinity 0–10 ppt. Large, showy pink flowers.
MALLOW, ROSE <i>Hibiscus moscheutos</i>	All	Coastal Plain	OBL	3-6 ft.	Slow	○	Flowers attractive to hummingbirds.	Brackish & fresh tidal marshes; saturated soils above MHT. Salinity 0-15 ppt. Large, showy white flowers.
MANNA GRASS <i>Glyceria canadensis</i>	6b	Piedmont.	OBL	3-6 ft.	Fast	○ - ◐	Seeds eaten by song-birds, waterfowl. Plants eaten by deer, muskrats.	Shallow fresh marshes, wet meadows, open forested wetlands. Cool-season grass.
MANNA GRASS, EASTERN <i>Glyceria septentrionalis</i>	All	Mostly Coastal Plain; common	OBL	3-6 ft.	Fast	○	Seeds eaten by song-birds, waterfowl. Plants eaten by deer, muskrats.	Shallow fresh marshes and wet meadows. Cool-season grass.
MANNA GRASS, FOWL <i>Glyceria striata</i>	All	Statewide; common	OBL	<3 ft.	Slow	○ - ◐	Seeds eaten by song-birds, waterfowl. Plants eaten by deer, muskrats.	Wet meadows. Cool-season grass. Contains prussic acid; can be poisonous to livestock.
MILLET, WALTER'S <i>Echinochloa walteri</i>	All	Mostly Coastal Plain; common	FACW+	<3 ft.	Slow	○	Seeds eaten by song-birds, waterfowl.	Shallow fresh marshes and wet meadows. Annual, warm-season grass.
REEDGRASS, BLUE-JOINT <i>Calamagrostis canadensis</i>	6b	Mostly Piedmont.	FACW+	3-6 ft.	Slow	○ - ◐	Stems, leaves, & rootstocks eaten by muskrats, deer.	Shallow fresh marshes, wet meadows, open forested wetlands. Cool-season grass.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/ Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
RUSH, SOFT <i>Juncus effusus</i>	All	Statewide; common	FACW+	<3 ft.	Slow	○	Seeds eaten by song-birds, waterfowl.	Shallow fresh marshes and wet meadows.
SMARTWEED, PENNSYLVANIA <i>Polygonum pensylvanicum</i>	All	Statewide; common	FACW	3-6 ft.	Fast	○	Seeds eaten by waterfowl, songbirds.	Shallow marshes and wet meadows. Small pink flowers.
SMARTWEED, SWAMP <i>Polygonum hydropiperoides</i>	All	Statewide; common	OBL	<3 ft.	Fast	○	Seeds eaten by waterfowl, songbirds.	Shallow fresh marshes and wet meadows. Small white flowers.
SWITCHGRASS <i>Panicum virgatum</i>	All	Mostly Coastal Plain; common	FAC	3-6 ft.	Slow	○	Seeds eaten by song-birds. Foliage eaten by rabbits, deer.	Wet meadows; shallow edges of fresh & brackish marshes. Warm-season grass. Salinity 0–10 ppt.
TEARTHUMB <i>Polygonum arifolium</i> <i>Polygonum sagittatum</i>	All	Statewide; common	OBL	Vine	Fast	○	Seeds eaten by waterfowl, songbirds.	Shallow fresh marshes and wet meadows. Small white-pink flowers. Many small prickles on stems.
WOOL-GRASS <i>Scirpus cyperinus</i>	All	Statewide; common	FACW+	3-6 ft.	Fast	○	Seeds eaten by song-birds, waterfowl. Rootstocks & foliage eaten by muskrats.	Shallow fresh marshes and wet meadows. A bulrush, not a grass.
WILD RICE <i>Zizania aquatica</i>	All	Mostly Coastal Plain	OBL	6-9 ft.	Slow	○	Seeds eaten by song-birds, waterfowl.	Mostly in tidal fresh marshes. Annual, cool-season grass.
Water Regime: Surface Saturation to +6 inches of Surface Water								
ARROW-ARUM <i>Peltandra virginica</i>	All	Mostly Coastal Plain; common	OBL	<3 ft.	Slow	○ - ◐	Seeds eaten by waterfowl, rails, muskrats.	Shallow marshes and stream edges. Salinity 0-2 ppt. Plant also known as “Duck Corn.” Inconspicuous green flowers.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/ Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
BURREED, AMERICAN <i>Sparganium americanum</i>	All	Statewide.	OBL	<3 ft.	Fast	○ - ●	Seeds eaten by water-fowl and rails. Stems and leaves eaten by muskrats.	Shallow fresh marshes, especially along rivers & streams. White flowers.
BURREED, GIANT <i>Sparganium eurycarpum</i>	All	Statewide; common	OBL	3-6 ft.	Fast	○	Seeds eaten by water-fowl and rails. Stems and leaves eaten by muskrats.	Shallow fresh marshes. White flowers.
BULRUSH, GREEN <i>Scirpus atrovirens</i>	All	Statewide; common	OBL	3-6 ft.	Fast	○	Seeds eaten by water-fowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh marshes and wet meadows.
BULRUSH, RIVER <i>Bolboschoenus fluviatilis</i> (formerly <i>Scirpus fluviatilis</i>)	All	Coastal Plain; common	OBL	3-6 ft.	Fast	○ - ●	Seeds eaten by water-fowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh marshes.
BULRUSH, SOFT-STEM <i>Schoenoplectus tabernaemontani</i> (formerly <i>Scirpus validus</i>)	All	Statewide; common	OBL	6-9 ft.	Fast	○	Seeds eaten by water-fowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh to slightly brackish marshes. Salinity 0-5 ppt.
BULRUSH, THREE-SQUARE <i>Schoenoplectus pungens</i> (formerly <i>Scirpus pungens</i>)	All	Statewide; common	FACW+	<3 ft.	Fast	○	Seeds eaten by water-fowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh to brackish marshes and open water fringes. Salinity 0–15 ppt.
CORDGRASS, SALTMARSH <i>Spartina alterniflora</i>	All	Coastal Plain	OBL	3-6 ft.	Fast	○	Seeds eaten by water-fowl & songbirds. Roots eaten by water-fowl and muskrats.	Tidal marshes between midtide and MHT. Warm-season grass. Salinity 0 – 35 ppt.
SEDGE, FOX <i>Carex vulpinoidea</i>	All	Statewide; common	OBL	<3 ft.	Slow	○	Seeds eaten by water-fowl, songbirds, rails. Foliage eaten by deer.	Shallow fresh marshes.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
SEDGE, FRINGED <i>Carex crinita</i>	All	Statewide; common	OBL	<3 ft.	Slow	○ - ▸	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Forested wetlands and thickets.
SEDGE, SHALLOW <i>Carex lurida</i>	All	Statewide; common	OBL	<3 ft.	Slow	○ - ▸	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Forested wetlands with shallow water and/or saturated soil.
SEDGE, THREE-WAY <i>Dulichium arundinaceum</i>	All	Statewide; common	OBL	<3 ft.	Slow	○	Foliage eaten by deer.	Shallow fresh marshes and openings in forested wetlands.
SEDGE, TUSsock <i>Carex stricta</i>	All	Statewide; common	OBL	<3 ft.	Slow	○	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Shallow fresh marshes and wet meadows.
SPIKERUSH, BLUNT <i>Eleocharis obtusa</i>	All	Statewide; common	OBL	<3 ft.	Slow	○ - ▸	Seeds and plants eaten by waterfowl, muskrats.	Shallow fresh marshes and open water fringes.
SWEETFLAG <i>Acorus americanus</i> (formerly <i>Acorus calamus</i>)	All	Statewide; more common on Coastal Plain	OBL	<3 ft.	Fast	○ - ▸	Roots eaten by waterfowl, muskrats.	Shallow fresh to brackish marshes, stream edges, and wet meadows on floodplains. Salinity 0-10 ppt. Inconspicuous green flowers.
Water Regime: Surface Saturation to +12 inches of Surface Water								
ARROWHEAD, BROADLEAF <i>Sagittaria latifolia</i>	All	Statewide; common	OBL	<3 ft.	Fast	○ - ▸	Seeds and tubers eaten by waterfowl, wading birds, muskrats.	Shallow fresh marshes. White flowers.
ARROWHEAD, RIGID <i>Sagittaria rigida</i>	All	Statewide	OBL	<3 ft.	Fast	○ - ▸	Seeds and tubers eaten by waterfowl, wading birds, muskrats.	Shallow fresh marshes. White flowers.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/ Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
CATTAIL, NARROW-LEAF <i>Typha angustifolia</i>	All	Mostly Coastal Plain; common	OBL	3-6 ft.	Fast	○	Rootstocks eaten by geese and muskrats. Stems also eaten by muskrats.	Shallow fresh and brackish marshes. Salinity 0-15 ppt. <u>Aggressive species</u> . Tends to dominate wetlands, to the exclusion of other plants. Should not be planted if a mix of plant species is desired.
CATTAIL, BROAD-LEAF <i>Typha latifolia</i>	All	Statewide; common	OBL	3-6 ft.	Fast	○	Rootstocks eaten by geese and muskrats. Stems also eaten by muskrats.	Shallow fresh marshes. <u>Aggressive species</u> . Tends to dominate wetlands, to the exclusion of other plants. Should not be planted if a mix of plant species is desired.
CLUB, GOLDEN <i>Orontium aquaticum</i>	All	Mostly Coastal Plain; uncommon elsewhere	OBL	<3 ft.	Fast	○	Seeds eaten by waterfowl, muskrats.	Tidal fresh marshes, shallow ponds, slow streams. Small yellow flowers on a spathe.
LIZARD'S-TAIL <i>Saururus cernuus</i>	All	Statewide; more common on Coastal Plain	OBL	<3 ft.	Fast	○ - ●	Occasionally eaten by wood ducks.	Shallow fresh marshes and openings in forested wetlands. Nodding spike of small white flowers.
PICKEREL-WEED <i>Pontederia cordata</i>	All	Statewide; more common on Coastal Plain	OBL	<3 ft.	Fast	○ - ●	Seeds and roots eaten by waterfowl. Flowers attractive to butterflies.	Shallow fresh to slightly brackish marshes and slow streams. Salinity 0-3 ppt. Showy, small blue flowers on spikes up to 6" long.

TABLE 2: Native Herbaceous Plants

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Height at Maturity	Rate of Spread	Sun/ Shade	Wildlife Value for Food	Natural Habitat and Other Characteristics
POND-LILY, YELLOW (SPATTERDOCK) <i>Nuphar lutea</i>	All	Statewide; common	OBL	<3 ft.	Fast	○ - ◐	Seeds eaten by water-fowl, muskrats. Stems also eaten by muskrats.	Tidal fresh marshes, shallow ponds, slow streams. Tolerates tidal inundation up to 3 feet. Large, heart-shaped leaves. Bright yellow flowers.
Water Regime: +12 inches to +36 inches of Surface Water, and Deeper								
LOTUS, AMERICAN <i>Nelumbo lutea</i>	All	Statewide; uncommon	OBL	3-6 ft.	Fast	○	Seeds eaten by water-fowl, muskrats. Stems also eaten by muskrats.	Shallow ponds, slow streams. Large, round leaves, floating or raised above the water. Can grow in water up to 6 feet deep. Pale yellow flowers on stalks extending up to 3 feet above the water.
WATER-LILY, WHITE <i>Nymphaea odorata</i>	All	Statewide; common	OBL	3-6 ft.	Fast	○ - ◐	Seeds eaten by water-fowl, muskrats. Stems also eaten by muskrats.	Tidal fresh marshes, shallow ponds and bogs. Can grow in water up to 4 feet deep. Leaves and flowers float on the water surface. Attractive white flowers.

TABLE 3: Native Shrubs

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/Shade	Height at 20 years	Wildlife Value for Food	Natural Habitat and Other Characteristics
Water Regime: Surface Saturation to Infrequent Inundation							
ALDER, SMOOTH <i>Alnus serrulata</i>	All	Statewide; less common on Coastal Plain	OBL	○ - ◐	10 ft.	Seeds eaten by ducks, quail, doves. Plants browsed by deer, beaver.	Shrub swamps and stream-banks. Nitrogen-fixing. Attractive catkins. Provides good cover for woodcock.
ARROWWOOD <i>Viburnum dentatum</i>	All	Statewide	FAC	○ - ◐	10 ft.	Berries eaten by turkey, grouse, songbirds, squirrels. Plants browsed by rabbits, deer.	Shrub swamps and forested wetlands. Suckers freely; wood used to make arrows. White flowers, bluish-black berries.
AZALEA, SWAMP <i>Rhododendron viscosum</i>	All	Statewide	OBL	○ - ◐	10 ft.	Flowers attractive to hummingbirds and butterflies. Plants browsed by deer.	Shrub swamps, forested wetlands, and streambanks. Showy pink-white tubular flowers.
BAYBERRY, NORTHERN <i>Myrica pensylvanica</i>	All	Coastal Plain	FAC	○ - ◐	10 ft.	Berries eaten by quail, songbirds. Plants browsed by deer.	Edges of tidal marshes and streams. Salinity 0-20 ppt. Need male and female plants for fruit production. Suckers to form colonies. Wax of berries used in candles.
BLUEBERRY, HIGHBUSH <i>Vaccinium corymbosum</i>	All	Coastal Plain	FACW-	○ - ◐	10 ft.	Berries eaten by songbirds, turkey, squirrel. Plants browsed by deer, rabbits.	Forested wetlands. Prefers acid soils. Slow growing.
BUSH, HIGH TIDE (GROUNDSEL) <i>Baccharis halimifolia</i>	7a, 7b	Coastal Plain	FACW	○	10 ft.	Minimal value for food. Occasionally browsed by deer.	Brackish and coastal marshes, usually above MHW. Salinity 0-15 ppt. Has fluffy white seeds. Male flowers & female flowers on separate plants.

TABLE 3: Native Shrubs

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/Shade	Height at 20 years	Wildlife Value for Food	Natural Habitat and Other Characteristics
BUSH, HIGH-TIDE (MARSH-ELDER) <i>Iva frutescens</i>	7a, 7b	Coastal Plain	FACW+	○	10 ft.	Minimal value for food. Occasionally browsed by deer.	Brackish and coastal marshes, usually above MHW. Salinity 0-15 ppt.
BUTTONBUSH <i>Cephalanthus occidentalis</i>	All	Statewide	OBL	○ - ◐	8 ft.	Flowers attractive to hummingbirds. Seeds eaten by ducks and rails. Plants browsed by deer.	Shrub swamps and streambanks. Unusual, round white flowers. Tolerates long periods of inundation.
CHOKEBERRY, BLACK <i>Aronia melanocarpa</i>	6b	Piedmont.	FAC	○ - ◐	8 ft.	Fruits eaten by songbirds, grouse, bear, squirrel. Plants browsed by deer, rabbits.	Shrub swamps and forested wetlands. Fruits may remain on shrubs for much of the winter. Tends to sucker.
CHOKEBERRY, RED <i>Aronia arbutifolia</i>	All	Statewide	FACW	○ - ◐	10 ft.	Fruits eaten by songbirds, grouse, bear, squirrel. Plants browsed by deer, rabbits.	Shrub swamps and forested wetlands. Fruits may remain on shrubs for much of the winter. Tends to sucker.
DOGWOOD, REDOSIER <i>Cornus sericea</i>	All	Statewide; uncommon	FACW+	○ - ◐	8 ft.	Berries eaten by songbirds, grouse, turkey, quail, squirrels. Plants browsed by deer, rabbits.	Forested wetlands and streambanks. Attractive red stem color. White flowers and fruit.
DOGWOOD, SILKY <i>Cornus amomum</i>	All	Statewide	FACW	○ - ◐	10 ft.	Berries eaten by songbirds, grouse, turkey, quail, squirrels. Plants browsed by deer, rabbits.	Forested wetlands and streambanks. Produces fruit at 3-5 years of age. White flowers with blue berries. Prefers some shade.
ELDERBERRY <i>Sambucus nigra</i> <i>ssp. canadensis</i> (formerly <i>S. canadensis</i>)	All	Statewide	FACW-	○ - ◐	12 ft.	Berries eaten by songbirds, turkey, squirrels. Plants browsed by deer, rabbits.	Shrub swamps and streambanks. Large clusters of white flowers followed by purple berries; fast growth rate. Suckers freely.

TABLE 3: Native Shrubs

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/Shade	Height at 20 years	Wildlife Value for Food	Natural Habitat and Other Characteristics
FETTERBUSH <i>Leucothoe racemosa</i>	All	Mostly Coastal Plain; common	FACW	○ - ◐	12 ft.	Seeds eaten by songbirds. Plants browsed by deer.	Shrub swamps, streambanks, and forested wetlands. Small white flowers in drooping racemes.
INKBERRY <i>Ilex glabra</i>	All	Coastal Plain	FACW-	○ - ◐	10 ft.	Berries eaten by songbirds, quail, and squirrels.	Shrub swamps, streambanks, forested wetlands. Black fruits persist during the winter. Extensive rhizomes, often forms colonies.
PEPPERBUSH, SWEET <i>Clethra alnifolia</i>	All	Coastal Plain	FAC+	○ - ◐	8 ft.	Flowers attractive to butterflies, other insects.	Shrub swamps and forested wetlands. Showy, fragrant white flower spikes in mid-summer, often when other flowers are less abundant.
POSSUM-HAW <i>Viburnum nudum</i>	All	Mostly Coastal Plain	OBL	○ - ◐	12 ft.	Berries eaten by turkey, grouse, songbirds, squirrels. Plants browsed by rabbits, deer.	Shrub swamps and forested wetlands. White flower clusters, blue berries. Fruits may remain for much of the winter.
ROSE, SWAMP <i>Rosa palustris</i>	All	Statewide; more common on Coastal Plain	OBL	○	6 ft.	Fruits eaten by songbirds. Plants browsed by deer.	Shrub swamps. Pink flowers, red fruits. Fruits may remain for much of the winter.
SPICEBUSH <i>Lindera benzoin</i>	All	Statewide	FACW-	○ - ●	12 ft.	Berries eaten by songbirds.	Forested wetlands. Prefers some shade. Fragrant leaves and twigs; yellow fall color. Bright red berries.
SWEETSPIRE, VIRGINIA <i>Itea virginica</i>	All	Coastal Plain	OBL	○ - ●	8 ft.	Flowers attractive to butterflies.	Shrub swamps and forested wetlands. Small white flowers in elongated clusters up to 6 inches long.

TABLE 3: Native Shrubs

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/Shade	Height at 20 years	Wildlife Value for Food	Natural Habitat and Other Characteristics
WAXMYRTLE, SOUTHERN <i>Myrica cerifera</i>	7a, 7b	Coastal Plain	FAC	○ - ◐	10 ft.	Berries eaten by quail, songbirds. Plants browsed by deer.	Edges of tidal marshes and streams. Salinity 0-10 ppt. Need male and female plants for fruit production. Wax of berries used in candles.
WITCH-HAZEL <i>Hamamelis virginiana</i>	All	Statewide; less common on Coastal Plain	FAC-	○ - ◐	15 ft.	Seeds eaten by grouse and squirrels. Plants browsed by deer.	Forested wetlands, often near streams. Bark is used for making witch-hazel lotion. Fragrant yellow flowers.
WINTERBERRY <i>Ilex verticillata</i>	All	Statewide; less common on Coastal Plain	FACW+	○ - ◐	10 ft.	Fruits eaten by songbirds, quail, and squirrels.	Shrub swamps and forested wetlands. Need male and female plants for fruit production. Bright red berries persist after leaves drop.

TABLE 4: Native Trees

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/Shade	Height at 20 Years	Wildlife Value for Food	Natural Habitat and Other Characteristics
DECIDUOUS TREES							
Water Regime: Surface Saturation to Infrequent Inundation							
ASH, GREEN <i>Fraxinus pennsylvanica</i>	All	Statewide	FACW	○ - ◐	35 ft.	Seeds eaten by ducks, gamebirds, songbirds, squirrels. Plants browsed by deer.	Streambanks, floodplains, and bottomland swamps. Important lumber tree.
BIRCH, RIVER <i>Betula nigra</i>	All	Mostly Coastal Plain; Piedmont, at lower elevations	FACW	○ - ◐	30 ft.	Seeds eaten by ducks and songbirds.	Streambanks and floodplains. Prefers full sun. Sometimes planted as an ornamental.
BOX-ELDER <i>Acer negundo</i>	All	Statewide; less common on Coastal Plain	FAC+	○	40 ft.	Seeds eaten by gamebirds, songbirds, squirrels. Browsed by deer.	Streambanks and floodplains. Tolerates drought. Grows rapidly.
COTTONWOOD, EASTERN <i>Populus deltoides</i>	All	Statewide	FAC	○ - ◐	60 ft.	Browsed by deer and rabbits. Buds and catkins eaten by squirrels and quail.	Streambanks and floodplains. Tolerates drought. Grows rapidly.
BALDCYPRESS <i>Taxodium distichum</i>	All	Coastal Plain.	OBL	○ - ◐	30 ft.	Seeds eaten by ducks and marsh birds.	Streambanks and bottomland swamps. Tolerates drought and prolonged inundation.
BLACKGUM <i>Nyssa sylvatica</i>	All	Statewide	FAC	○ - ◐	30 ft.	Fruits eaten by squirrels, quail, turkey, and songbirds. Browsed by deer.	Streambanks, floodplains, and other wet areas. Tolerates drought. Foliage turns bright red in early fall.
GUM, SWEET <i>Liquidambar styraciflua</i>	All	Mostly Coastal Plain	FAC	○ - ◐	40 ft.	Seeds eaten by songbirds, squirrels, and chipmunks.	Streambanks, floodplains, and other wet areas. Tolerates drought.

TABLE 4: Native Trees

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/ Shade	Height at 20 Years	Wildlife Value for Food	Natural Habitat and Other Characteristics
MAGNOLIA, SWEETBAY <i>Magnolia virginiana</i>	All	Coastal Plain	FACW+	○ - ●	15 ft.	Seeds eaten by songbirds, squirrels. Browsed by deer.	Streambanks, floodplains, and other wet areas. Considered a small tree or shrub. May be evergreen in mild winters. Creamy white flowers up to 3" diameter.
MAPLE, RED <i>Acer rubrum</i>	All	Statewide	FAC	○ - ◐	35 ft.	Seeds eaten by ducks, gamebirds, songbirds, squirrels. Browsed by deer.	Streambanks, floodplains, and other wet areas. Tolerates drought.
MAPLE, SILVER <i>Acer saccharinum</i>	All	Statewide; less common on Coastal Plain	FACW	○ - ◐	40 ft.	Seeds eaten by ducks, gamebirds, songbirds, squirrels. Browsed by deer.	Streambanks and floodplains. Tolerates drought. Good source of woody debris for riparian systems.
OAK, PIN <i>Quercus palustris</i>	All	Statewide	FACW	○	35 ft.	Acorns eaten by wood ducks, quail, turkey, grouse, squirrels, and deer.	Floodplains and other wet areas. Tolerates drought. Widely planted as an ornamental. Produces small acorns.
OAK, SOUTHERN RED <i>Quercus falcata</i>	7a, 7b	Mostly Coastal Plain; infrequent elsewhere	FACU-	○	35 ft.	Acorns eaten by wood ducks, quail, turkey, grouse, squirrels, and deer.	Floodplains and other wet areas. Tolerates drought.
OAK, SWAMP CHESTNUT <i>Quercus michauxii</i>	All	Mostly Coastal Plain; infrequent elsewhere	FACW	○ - ◐	30 ft.	Acorns eaten by wood ducks, quail, turkey, grouse, squirrels, and deer.	Floodplains and other wet areas. Important lumber tree.
OAK, SWAMP WHITE <i>Quercus bicolor</i>	All	Mostly Coastal Plain; infrequent elsewhere	FACW+	○ - ◐	30 ft.	Acorns eaten by wood ducks, quail, turkey, grouse, squirrels, and deer.	Floodplains and other wet areas. Important lumber tree. Requires acid soils.
OAK, WILLOW <i>Quercus phellos</i>	All	Mostly Coastal Plain; infrequent elsewhere	FAC+	○ - ◐	30 ft.	Acorns eaten by wood ducks, quail, turkey, grouse, squirrels, and deer.	Floodplains and other wet areas. Frequently used as an ornamental planting. Produces small acorns.

TABLE 4: Native Trees

Plant Names	Plant Hardiness Zone	Geographic Distribution in Delaware	Wetland Indicator Status	Sun/Shade	Height at 20 Years	Wildlife Value for Food	Natural Habitat and Other Characteristics
PAWPAW <i>Asimina triloba</i>	All	Statewide; infrequent	FACU+	○ - ◐	20 ft.	Fruits eaten by fox, raccoon, and opossum.	Streambanks, floodplains, and other wet areas. Considered a small tree or shrub. Suckers and forms colonies. Dark purple flowers; large yellow fruits.
SYCAMORE <i>Platanus occidentalis</i>	All	Statewide	FACW-	○ - ◐	40 ft.	Seeds eaten by songbirds and squirrels.	Streambanks and floodplains. Unique peeling bark, fast growth rate. Good den tree.
WILLOW, BLACK <i>Salix nigra</i>	All	Statewide	FACW+	○	60 ft.	Browsed by grouse, beaver, and deer.	Streambanks and floodplains. Fast growth rate. Can be invasive.
CEDAR, ATLANTIC WHITE <i>Chamaecyparis thyoides</i>	All	Lower Eastern Shore; uncommon	OBL	○ - ◐	25 ft.	Seeds eaten by songbirds. Browsed by deer.	Streambanks, bottomland swamps, and other wet areas. Tolerates frequent and prolonged inundation, but prefers a fluctuating water table. Cannot compete with hardwoods; best planted in solid stands.
HOLLY, AMERICAN <i>Ilex opaca</i>	All	Mostly Coastal Plain	FACU+	○ - ●	20 ft.	Fruits eaten by songbirds, quail, and squirrels.	Streambanks, bottomland swamps, and other wet areas. Need male and female plants for fruit production.
PINE, LOBLOLLY <i>Pinus taeda</i>	All	Mostly Coastal Plain	FAC-	○	45 ft.	Seeds eaten by songbirds, quail, turkey. Browsed by deer and rabbits.	Streambanks, floodplains, and other wet areas. Important lumber tree on the Coastal Plain. Grows rapidly.

TABLES 2 –4: NOTES

1. All species listed in these tables are “native,” i.e., they occur naturally in the state of Delaware. Due to page limitations, this listing is not all-inclusive. There are many more native wetland plants which occur in Delaware and may be suitable for use in wetland restoration.
2. Plant Hardiness Zone and Geographic Distribution: The USDA plant hardiness zones indicate where a species can be successfully planted in Delaware, while the geographic distribution describes where the species usually occurs under natural conditions.

3. Wetland Indicator Status:

OBL (obligate): Species occurs in wetlands >99 percent of the time. Usually requires semipermanent to permanent saturation of the soil surface or inundation with water.

FACW (facultative wet): Species occurs in wetlands 67 - 99 percent of the time. Usually prefers seasonal to semi-permanent saturation/inundation, but may tolerate periods of dryness late in the growing season.

FAC (facultative): Species occurs in wetlands 34 - 66 percent of the time. Tolerant of a wide range of hydrologic conditions, ranging from semi-permanent saturation/inundation to extended periods of dryness.

FACU (facultative upland): Species occurs in wetlands 1 - 33 percent of the time. Tolerant of a wide range of hydrologic conditions, ranging from seasonal saturation/inundation to extended periods of dryness.

The (+) and (-) modifiers for OBL, FACW, FAC, and FACU means that the plant tends toward the upper or lower end of the range.

4. Except as noted in the tables, most woody plants do not tolerate extended periods of inundation (surface water) during the growing season. Occasional inundation during the growing season is tolerated, as is inundation during the dormant period (late fall through early spring).
5. Relative rate of spreading of herbaceous species (Table 2), under ideal conditions:
 - Slow: spreading at a rate <0.5 ft. per year.
 - Fast: spreading at a rate of \geq 0.5 ft. per year.
6. Sun - Shade:
 - Full Sun – at least 6 hours of light per day or 4 hours of midday sun
 - ◐ Part Shade - 3 to 6 hours of light per day
 - Shade - less than 3 hours of light per day